Application No.: 10/624,208
Amendment

AMENDMENTS TO THE CLAIMS

1. (Original)   A method of encoding a data byte, comprising the steps of:

selecting an irreducible polynomial;

generating an error control code as a function of the polynomial and the data; and generating an encoded data matrix wherein the data and the error control code comprise the elements of the matrix;

dispersing an element of the encoded data matrix to a selected one of a plurality of channels based upon a position of the element in the matrix.

2. (Cancelled)

3. (Original)   The method of claim 1, wherein:

the error control code is the same length as the data byte.

4. (Original)   The method of claim 2, wherein the data is digitally represented by eight bits and further wherein:

the polynomial is selected as an eighth degree polynomial.

5. (Currently Amended)   The method of claim 4, wherein the polynomial is in the form of $1+x^3+x^4[[4]]+x^5+x^8$.

6. (Currently Amended)   The method of claim 4, wherein the polynomial is in the form of $1+x+x^2+x^4[[4]]+x^6+x^7+x^8$.

7. (Original)   The method of claim 1, wherein the error control code is generated by dividing the data by the polynomial, the error control code being the remainder modulo the polynomial.

8. (Original)   The method of claim 1, wherein six pair combinations of row elements can be equated to a data row element pair.

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9. (Original)   The method of claim 1, wherein six pair combinations of column elements can be equated to a data row element pair.

10. (Original)   The method of claim 1, wherein pair combinations of elements can be equated to any other pair of elements.

11. (Currently Amended)   The method of claim 1, comprising the further steps of forming a second error control code of two additional row elements, whereby further pair combination of row elements or column elements can be equated to any other pair combination of all but three~~any~~ other ~~pair combination~~combinations of row elements ~~or column elements~~.

12. (Original)   The codeword of claim 1 wherein each codeword element is sent to a separate device.

13. (Original)   A method of encoding data in the form of a data byte $Di=d0d1d2d3d4d5d6d7$ comprising the steps of:

selecting an irreducible error correcting eighth degree polynomial;

dividing the data byte by the polynomial to produce an error correction code in the form $Ei=e0e1e2e3e4e5e6e7$; and

generating an encoded data word in the form $d0d1d2d3d4d5d6d7e0e1e2e3e4e5e6e7$.

14. (Currently Amended)   The method of claim 13, wherein the polynomial is in the form of
$1+x^1 3+x^4[[4]]+x^5 5+x^8 8$.

15. (Currently Amended)   The method of claim 13, wherein the polynomial is in the form of
$1+x+x^2 2+x^4[[4]]+x^6 6+x^7 7+x^8 8$.

16. (Currently Amended)   The method of claim 13, wherein the error control code is generated by dividing the data by the polynomial, the error control code being the remainder modulo the polynomial; and generating an encoded data word in the form

$d0\ d1\ d2\ d3\ d4\ d5\ d6\ d7$
$e0\ e1\ e2\ e3\ e4\ e5\ e6\ e7.$

17. (Original)   The method of claim 13, comprising the further step of:
    forming the encoded data word as an array.

18. (Original)   The method of claim 17, wherein multiple data bytes are encoded and formed as encoded data words, the encoded data words being formed into an array of arrays.

19. (Original)   The method of claim 18, further comprising:
    forming a error detection code for every element in the rows and columns of the array of arrays.

20. (Currently Amended)   The method of claim 19, wherein error recovery is desired and is accomplished by the further steps of:
    counting errors in a codeword in a column;
    counting errors in a codeword in a row;
    using columnrow equations to correct errors if the number of columnrow errors is less than row errors;
    using rowcolumn equations otherwise.

21. (Original)   The method of claim 19, wherein error recovery is desired and is accomplished by the further steps of:
    counting errors in a codeword in a column;
    counting errors in a codeword in a row;
    using row equations to correct errors if the number of row errors is less than or equal to column errors;
    using column equations otherwise.

22. (Currently Amended)   The method of claim 17, comprising the further step of:
    forming the encoded data word as a 4x4 array.

23. (Original)   The method of claim 17, comprising the further step of:
   forming the encoded data word as a 3x4 array.

24. (Original)   The method of claim 17, comprising the further step of:
   forming the encoded data word as a 4x3 array.

25. (Original)   The method of claim 17, comprising the further step of:
arranging the matrix so that each element of the data byte is horizontally or vertically adjacent to
at least three other elements of the data byte.

26. (Original)   The method of claim 17, comprising the further step of:
arranging the matrix so that each element of the data byte and the error control byte is a row of
the matrix.

27. (Original)   The method of claim 17, comprising the further step of:
   forming the encoded data matrix as
   d0d1d2d3
   d4d5d6d7
   e0e1e2e3
   e4e5e6e7.

28. (Canceled)

29. (Currently Amended)   The method of claim 33~~28~~, wherein in the event that up to two of
the devices fails, a method of recovering lost data includes the step of:
   determining which of the first through fourth devices that has not failed and contains
error correction codes for data on a ~~drive~~device that has failed;
   retrieving the dispersed combination of error correction codes and data from the device
so selected;
   recreating data dispersed to a failed device using the known data and error correction
codes in the equations below to recreate lost data

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$$e0 = d0 + d3 + d4 + d5 + d6$$
$$e1 = d1 + d4 + d5 + d6 + d7$$
$$e2 = d2 + d5 + d6 + d7$$
$$e3 = d0 + d4 + d5 + d7$$
$$e4 = d0 + d1 + d3 + d4$$
$$e5 = d0 + d1 + d2 + d3 + d6$$
$$e6 = d1 + d2 + d3 + d4 + d7$$
$$e7 = d2 + d3 + d4 + d5.$$

30. (Currently Amended)   The method of claim 33~~29~~, wherein in the event that up to two of
the devices fails, a method of recovering lost data includes the step of:

determining which of the first through fourth devices that has not failed and contains
error correction codes for data on a ~~drive~~device that has failed;

retrieving the dispersed combination of error correction codes and data from the device
so selected;

recreating data dispersed to a failed device using the known data and error correction
codes in the equations below to recreate lost data

$$e0 = d0 + d1 + d3 + d6$$
$$e1 = d0 + d2 + d3 + d4 + d6 + d7$$
$$e2 = d0 + d4 + d5 + d6 + d7$$
$$e3 = d1 + d5 + d6 + d7$$
$$e4 = d0 + d1 + d2 + d3 + d7$$
$$e5 = d1 + d2 + d3 + d4$$
$$e6 = d0 + d1 + d2 + d4 + d5 + d6$$
$$e7 = d0 + d2 + d5 + d7.$$

31. (Original)   A method of encoding a data byte, comprising the steps of:

selecting an irreducible polynomial;

generating a first error control code as a function of the polynomial and the data;

generating a second error control code as a function of the polynomial and the data;

generating an encoded first data matrix wherein the data and the first error control codes comprise the elements of the matrix;

generating an encoded second data matrix wherein the data and the first and second error control codes comprise elements of the matrix; and

dispersing an element of the encoded data matrix to a selected one of a plurality of channels based upon a position of the element in the matrix.

32. (Cancelled)

33. (New)   The method of claim 27, comprising the further steps of :

dispersing the first row of the matrix to a first device;

dispersing the second row of the matrix to a second device;

dispersing the third row of the matrix to a third device;

dispersing the fourth row of the matrix to a fourth device; and

dispersing each column of the matrix to one of the first through fourth devices such that only one column from the matrix is stored on any of the first through fourth storage devices.

34. (New) The method of claim 29, wherein in the event that up to two of the devices fails, a method of recovering lost data includes the step of:

determining which of the first through fourth devices that has not failed and contains error correction codes for data on a device that has failed;

retrieving the dispersed combination of error correction codes and data from the device so selected;

recreating data dispersed to a failed device using the known data and error correction codes using the equations to recreate lost data when:

decoding with inputs s and u rows available,
$d0 = d0$
$d1 = d1$
$d2 = d2$
$d3 = d3$
$d4 = d1 + d2 + e1 + e2$
$d5 = d2 + d3 + e0 + e2 + e3$
$d6 = d0 + d1 + e1 + e3$

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$d7 = d0 + d1 + d3 + e0 + e1;$

decoding with inputs s and v rows available,
$d0 = d0$
$d1 = d1$
$d2 = d2$
$d3 = d3$
$d4 = d0 + d1 + d3 + e4$
$d5 = d0 + d1 + d2 + e4 + e7$
$d6 = d0 + d1 + d2 + d3 + e5$
$d7 = d0 + d2 + e4 + e6;$

decoding with inputs t and u rows available,
$d0 = d4 + d5 + d7 + e3$
$d1 = d4 + d5 + d6 + d7 + e1$
$d2 = d5 + d6 + d7 + e2$
$d3 = d6 + d7 + e0 + e3$
$d4 = d4$
$d5 = d5$
$d6 = d5$
$d7 = d7;$

decoding with inputs t and v rows available
$d0 = d4 + d6 + d7 + e5 + e6$
$d1 = d5 + d7 + e6 + e7$
$d2 = d4 + d6 + e4 + e5$
$d3 = d5 + d6 + e4 + e5 + e7$
$d4 = d4$
$d5 = d5$
$d6 = d6$
$d7 = d7;$ or

decoding with inputs u and v rows available,
$d0 = e2 + e3 + e4 + e5$
$d1 = e0 + e3 + e4 + e5 + e6$
$d2 = e1 + e4 + e5 + e6 + e7$
$d3 = e3 + e4 + e6 + e7$
$d4 = e0 + e2 + e3 + e7$
$d5 = e0 + e1 + e2 + e5$
$d6 = e0 + e1 + e2 + e3 + e6$
$d7 = e1 + e2 + e3 + e4 + e7$

35. (New) The method of claim 29, wherein in the event that up to two of the devices fails, a
method of recovering lost data includes the step of:

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determining which of the first through fourth devices that has not failed and contains error correction codes for data on a device that has failed;

retrieving the dispersed combination of error correction codes and data from the device so selected;

recreating data dispersed to a failed device using the known data and error correction codes using the equations to recreate lost data when

decoding with inputs w and x columns available,

$$d0 = d0$$
$$d1 = d1$$
$$d2 = d1 + d4 + d5 + e0 + e5$$
$$d3 = d0 + d1 + d4 + e4$$
$$d4 = d4$$
$$d5 = d5$$
$$d6 = d1 + d5 + e0 + e4$$
$$d7 = d4 + e0 + e1 + e4;$$

decoding with inputs w and y columns available,

$$d0 = d0$$
$$d1 = d0 + e0 + e2 + e6$$
$$d2 = d2$$
$$d3 = d4 + e0 + e2 + e4 + e6$$
$$d4 = d4$$
$$d5 = d0 + d6 + e2 + e4 + e6$$
$$d6 = d6$$
$$d7 = d0 + d2 + e4 + e6;$$

decoding with inputs w and z columns available,

$$d0 = d0$$
$$d1 = d0 + d3 + d4 + e4$$
$$d2 = d0 + d3 + d7 + e3 + e7$$
$$d3 = d3$$
$$d4 = d4$$
$$d5 = d0 + d4 + d7 + e3$$
$$d6 = d3 + d7 + e0 + e3$$
$$d7 = d7;$$

decoding with inputs x and y columns available,

$$d0 = d1 + d5 + e1 + e5 + e6$$
$$d1 = d1$$
$$d2 = d2$$
$$d3 = d2 + d5 + d6 + e1 + e6$$
$$d4 = d1 + d2 + e1 + e2$$
$$d5 = d5$$

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d6  =  d6
d7  =  d2 + d5 + d6 + e2;
```

decoding with inputs x and z columns available,
```
d0  =  d7 + e1 + e5 + e7
d1  =  d1
d2  =  d3 + e1 + e3 + e5
d3  =  d3
d4  =  d5 + e1 + e3 + e5 + e7
d5  =  d5
d6  =  d1 + d7 + e3 + e5 + e7
d7  =  d7; or
```

decoding with inputs y and z columns available,
```
d0  =  d2 + d3 + d7 + e3 + e7
d1  =  d2 + d6 + e2 + e6 + e7
d2  =  d2
d3  =  d3
d4  =  d3 + d6 + d7 + e2 + e7
d5  =  d2 + d6 + d7 + e2
d6  =  d6
d7  =  d7.
```

36. (New)   The method of claim 30, wherein in the event that up to two of the devices fail,
a method of recovering lost data includes the step of:

determining which of the first through fourth devices that has not failed and
contains error correction codes for data on a device that has failed;

retrieving the dispersed combination of error correction codes and data from the
device so selected;

recreating data dispersed to a failed device using the known data and error
correction codes using the equations to recreate lost data when

decoding with inputs s and u rows available,
```
d0 = d0
d1 = d1
d2 = d2
d3 = d3
d4 = d0 + d1 + e2 + e3
d5 = d2 + d3 + e1 + e2
d6 = d0 + d1 + d3 + e0
d7 = d0 + d2 + e0 + e1 + e2 + e3
```

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decoding with inputs s and v rows available,
d0 = d0
d1 = d1
d2 = d2
d3 = d3
d4 = d1 + d2 + d3 + e5
d5 = d1 + d3 + e4 + e7
d6 = d0 + d1 + e4 + e5 + e7
d7 = d0 + d1 + d2 + d3 + e4;

decoding with inputs t and u rows available,
d0 = d4 + d5 + d6 + d7 + e2
d1 = d5 + d6 + d7 + e3
d2 = d4 + d5 + d6 + e0 + e3
d3 = d4 + d6 + e0 + e2 + e3
d4 = d4
d5 = d5
d6 = d5
d7 = d7;

decoding with inputs t and v rows available
d0 = d4 + d7 + e4 + e5
d1 = d4 + d6 + d7 + e6 + e7
d2 = d4 + d5 + e4 + e5 + e7
d3 = d4 + d5 + d6 + d7 + e4 + e6
d4 = d4
d5 = d5
d6 = d6
d7 = d7; or

decoding with inputs u and v rows available,
d0 = e0 + e2 + e5 + e7
d1 = e1 + e2 + e3 + e5 + e6 + e7
d2 = e3 + e4 + e5 + e6
d3 = e0 + e4 + e5 + e6 + e7
d4 = e0 + e1 + e2 + e6
d5 = e0 + e1 + e2 + e3 + e7
d6 = e0 + e1 + e3 + e4 + e5 + e7
d7 = e1 + e4 + e6 + e7.

37. (New)   The method of claim 30, wherein in the event that up to two of the devices fails, a method of recovering lost data includes the step of:

determining which of the first through fourth devices that has not failed and contains error correction codes for data on a device that has failed;

retrieving the dispersed combination of error correction codes and data from the

device so selected;

recreating data dispersed to a failed device using the known data and error

correction codes using the equations to recreate lost data when

decoding with inputs w and x columns available,

$$d0 = d0$$
$$d1 = d1$$
$$d2 = d0 + d1 + e0 + e1 + e4 + e5$$
$$d3 = d0 + d4 + e0 + e1 + e4$$
$$d4 = d4$$
$$d5 = d5$$
$$d6 = d1 + d4 + e1 + e4$$
$$d7 = d0 + d4 + e4 + e5;$$

decoding with inputs w and y columns available,

$$d0 = d0$$
$$d1 = d6 + e0 + e2 + e4 + e6$$
$$d2 = d2$$
$$d3 = d0 + e2 + e4 + e6$$
$$d4 = d4$$
$$d5 = d0 + d2 + d4 + e0 + e2 + e4$$
$$d6 = d6$$
$$d7 = d2 + d6 + e0 + e4;$$

decoding with inputs w and z columns available,

$$d0 = d0$$
$$d1 = d0 + d7 + e0 + e3 + e4 + e7$$
$$d2 = d3 + e0 + e3 + e7$$
$$d3 = d3$$
$$d4 = d4$$
$$d5 = d0 + d3 + d7 + e0 + e3$$
$$d6 = d3 + e3 + e4 + e7$$
$$d7 = d7;$$

decoding with inputs x and y columns available,

$$d0 = d2 + d6 + e1 + e2 + e5 + e6$$
$$d1 = d1$$
$$d2 = d2$$
$$d3 = d2 + d5 + e1 + e2$$
$$d4 = d1 + d5 + e1 + e2 + e5$$
$$d5 = d5$$
$$d6 = d6$$
$$d7 = d1 + d2 + e2 + e6;$$

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decoding with inputs x and z columns available,

$d0 = d5 + e1 + e3 + e5$
$d1 = d1$
$d2 = d7 + e1 + e3 + e5 + e7$
$d3 = d3$
$d4 = d1 + d3 + d7 + e1 + e3 + e7$
$d5 = d5$
$d6 = d1 + d5 + d7 + e3$
$d7 = d7$; or

decoding with inputs y and z columns available,

$d0 = d6 + d7 + e2 + e3 + e6 + e7$
$d1 = d2 + d7 + e2 + e6$
$d2 = d2$
$d3 = d3$
$d4 = d2 + d6 + e2 + e7$
$d5 = d2 + d6 + e2 + e3 + e6$
$d6 = d6$
$d7 = d7$.